Connections: Bringing Together the Next Generation of Women Leaders in Science, Technology, Engineering and Mathematics

Held at the National Women's Education Center, Saitama, Japan on July 5-7th, 2010

This meeting was designed to bring together women scientists from the US and Japan whose achievements already show the promise that their work will have major impacts on their fields of study. We included researchers who have expertise in emerging areas and who are interested in ways to broaden their approach through new collaborations and by exploring new concepts, approaches and technologies. While *Connections* is the name of the meeting, it is also the theme. We are intending to establish connections between researchers, to cross-disciplinary boundaries to advance science, and to strengthen international partnerships. While the primary goal of the meeting is to broaden and support the research agendas of the participants, this meeting has also served to develop future leaders in science and engineering by offering networking opportunities and encouraging discussion on the institutional environment and culture that are conducive to nurturing women STEM leaders.

Organization of the Meeting

The organizing committee consisted of the following individuals.

Mitiko Go (co-chair)
Executive Director, Research Organization of Information and Systems

Kashiko Kodate
Professor Emeritus, Japan Women's University

Sachiyo Suita
Executive Vice-President, Kyushu University

Shirley J. Dyke (co-chair)
Professor of Mechanical and Civil Engineering, Purdue University

Patricia Rankin
Professor of Physics, Faculty Director, University of Colorado, Boulder

Mary E. Clutter
Assistant Director for Biological Sciences (retired)

The organizing committee held numerous teleconferences for the planning of the meeting. In between the international teleconferences, there were smaller group meetings focusing on specific issues. The agenda was developed to discuss the ways in which this group of researchers could have an impact on solving the big problems in science and engineering. We focused on a combination of technical-oriented sessions and sessions dedicated to empowering the women participating in the meeting. Open and closed sessions were included in the agenda. The keynote lectures and panel discussion were open to a broader audience to improve awareness of the issues related to women in science and engineering in Japan. About 10 younger observers were also invited from Japan.

MONDAY, July 5, 2010

	DAY 1 / AFTERNOON
1:00pm - 6:00pm	**CHECK IN, ORIENTATION (U.S. Participants)**
6:00 pm - 8:00 pm	**WELCOME DINNER (CLOSED)**
	Get to know each other. Announcement of upcoming schedule. Closed to core participants

TUESDAY, July 6, 2010

	DAY 2 / MORNING					
7:30 am - 8:30 am	Breakfast, Transition					
	POSTER PRESENTATION *(CLOSED)* **Posters remain up throughout the day**					
8:30 am - 9:15 am	GROUP A: Presentation + Q&A					
9:15 am -10:00am	GROUP B: Presentation + Q&A					
	KEYNOTE SPEECHES (AUDITORIUM, OPEN)					
10:00 am - 11:00 am	**Dr. M.R.C. Greenwood, President of University of Hawaii**					
11:00 am -12:00pm	**Dr. Chieko Asakawa, IBM Fellow, IBM Japan**					
	DAY 2 / AFTERNOON					
12:00 pm - 1:30 pm	**Lunch with the Keynote Speakers and Panelists (OPEN)**					
1:30 pm - 3:00 pm	**PANEL DISCUSSION (CONFERENCE ROOM, OPEN)**					
	Moderator: Dr. Go					
	Dr. Greenwood (US)	**Dr. Dyke (US)**	**Dr. Clutter (US)**	**Dr. Asakawa (JPN)**	**Dr. Anzai (JPN)**	**Dr. Suita (JPN)**
	Successfully Growing Female Leaders in Science & Engineering ***(Moderator poses questions, 4-6 speaker answer. If possible, include keynote speakers among the panelists.)***					
	Questions and Answers					

3:00 pm - 3:30 pm	Coffee Break
	BREAKOUT SESSION 1 (CLOSED)
3:30 pm - 5:00 pm	***BREAKOUT 1: Building Connections to Advance Future Directions of S&E"***
5:00 pm - 5:15 pm	Transition
5:15 pm - 6:00 pm	**Reception with Core Participants and University President (casual)(CLOSED)**
6:00 pm - 8:00 pm	**Dinner with Core Participants and University President (casual)(CLOSED)**

WEDNESDAY, July 7, 2010

	DAY 3 / MORNING (CLOSED)
7:30 am - 8:30 am	**Breakfast**
	BREAKOUT SESSION 2 (CLOSED)
8:30 am - 9:30 am	***Topic Specific Sessions (Environment, Disaster Response, etc)***
	Break entire group into research areas to have discussions focused along topic areas. Perhaps identify topics based on the previous discussion?
	BREAKOUT SESSION 3 (CLOSED)
9:30 am - 10:30 am	***Building Leadership Skills***
	(Including success stories and challenges to international collaboration)
10:30 am - 11:00 am	Coffee Break
	REPORT OUT / WRAP UP (CLOSED)
11:00 am - 12:00 pm	**Lessons Learned and Next Steps**
12:00 pm - 1:00 pm	**Closing Lunch**

Keynote Speakers:

Two excellent keynote speakers were a part of the meeting. These speakers provided excellent models for the emerging leaders in attendance. Both also stayed for most of the activities throughout the symposium and participated in the breakout sessions and discussions.

Dr. M.R.C. Greenwood, President of the University of Hawai'I System

The Changing Picture for Women in Science and Higher Education

Dr. Chieko Asakawa, IBM Fellow, IBM Japan

Accessibility: Bringing Change to the World

Panel Discussion: Successfully Growing Female Leaders in Science and Engineering

Panelists included: Dr. Greenwood, Dr. Dyke, Dr. Clutter, Dr. Asakawa, Dr. Anzai and Dr. Suita

The panel was convened and Dr. Go initiated the discussion by asking a number of questions to the panelists about their experiences and careers. Then the audience began to ask questions, resulting in an excellent discussion on a number of important issues. One interesting aspect of the discussion also focused on the cultural differences between Japan and the US that affect the mechanisms that can foster progress toward involving more women in highly technical fields and in leadership roles. Some main outcomes of the discussion include:

- In both the US and Japan researchers can apply for small grants specifically dedicated to women to facilitate research initiation and travel to begin new collaborations. These opportunities should be exploited.
- Social networking capabilities may offer new opportunities for women to advance. The workday is no longer 9-5 and thus our working time is more flexible with greater access to our colleagues.
- Universities are beginning to exploit the use of social networking and teleconferencing tools for meetings. IT tools are being used for meetings more frequently.
- Many universities in the US and Japan have established mentoring programs that are an effective opportunity for women to make connections with their colleagues. Also, young researchers should seek mentors outside of their university circle as well. It may be possible for women at one institution to invite women from another institution for a colloquium or guest visit.
- Promotion procedures may need to adapt to recognize real impact in a field (as opposed to simply counting research dollars or publications) and to encourage a broader set of activities to be considered for promotion as scholarly contributions when assessing suitability.
- Changes in the perspective toward women researchers will only be made when those at the highest levels of the university system encourage the institution to transform. For example, supporting a strong childcare and eldercare system is crucial for improving working conditions.
- Legislation may be needed in the end when all else fails. For instance, Title IX of the Higher Education Act

of 1972 in the US has been extremely effective in involving more women in sports. The law requires equal opportunities for men and women in programs supported by Federal funds.

Breakout 1: Building Connections to Advance Future Directions of Science and Engineering

In this breakout session, the objective was to discuss the topics in which major advances may be made in the near term, especially at the boundaries between disciplines. The participants were divided into three groups for this discussion. The outcomes of the discussion in each group were:

Group A

1. Mathematical modeling & statistical computation, predictive models
2. Next generation sequencing technologies
   Scalable methods, handling large data sets, computational needs
3. Astrophysics, large data sets, need faster, scalability issues, data interpretation, imaging analysis
4. NSF Frontiers of Science program
5. IT is needed to enable several of the above topics

Group B

1. Human-Technology interactions - cyber-physical-social
2. Sensor Networks & Data mining
3. New Materials & Energy and Environment and Green innovations
4. Bio-informatics & Remote medical care
5. Agriculture & genetically modified foods

Group C

1. Nanoscale, cheap, real-time, sensors / probes
2. Large data sets, visualization needs for management and interpretation,
   need to interact with perception people (how do we think and visualize), virtual reality
3. Multi-scale problems in time and space
4. Sustainable agriculture
5. Global databases, sharing vs. cybersecurity
6. Clean energy
7. Materials, including biological, by design

After this session, the organizing committee convened to discuss how to use the outcomes of Breakout 1 to select three areas for discussion in Breakout 2. Participants were allowed to select the topic that interested them most for Breakout 2.

Breakout 2: Topic-based Discussions Leading to Recommended Grand Challenges

Three areas were identified based on the discussions in Breakout 1 to develop several ideas for grant challenge projects. The objective was to discuss the focus and goals of each grand challenge, the synergies for the two countries, and the mechanisms needed to establish a successful program in each area.

IT Enabled Advances

Tremendous strides would be possible in several fields with the sharing and advanced interpretation of large, well-described data sets. However the challenge lies in making systems that are useful and useable by a wide variety of researchers. We propose to engage the broader scientific community, as well as the public, in building such a system for accessing data from and for several disciplines. Thus, appropriate metadata is required in such a database in order to ensure that the data one research team acquires can be understood by other research teams, perhaps in a different area, looking at the data from a different perspective. This goal has very high potential for impact, but is also very time consuming and costly, and requires a tremendous amount of planning.

This group focused on a grand challenge problem revolving around building the next generation of data interfaces to facilitate download, interpretation and visualization of data. Several fields would benefit from this type of system,

for example genomics, astrophysics, and strong motion monitoring. There are significant research needs involved in ensuring that the data is understandable and complete, is searchable and accessible by a broad audience and is available to multi-lingual audiences. Additionally, the visualization of the data must be designed to work for a wide variety of users, and thus the perception of the displays is important.

There are numerous synergies between the different countries and different types of researchers. For instance, there are technical advances needed for distributed processing (the next generation of cloud computing), international accessibility, high performance computing environments. Furthermore this is an opportunity to bring social and educational aspects into the research, for instance how to research different audiences and how to improve scientific literacy. In Japan, scientific literacy is widespread, whereas in the US we need to improve the scientific literacy of the majority of the public.

The suggested mechanism for such a project is to develop a couple of pilot projects based on likely fields in which this idea would have an impact. Virtual labs would be developed at a smaller scale to develop the approach, explore mechanisms for success, and test a realistic implementation. Such a pilot study would also be used to engage the public as well as the scientific community in such a setting. Appropriate standards and procedures would need to be introduced. Possible topics would include the biological sciences, astrophysics and strong motion monitoring data.

Tasks needed to establish such a virtual laboratory would likely be distributed among the participants, including core IT and database development, algorithm development, metadata standards, data mining methods, security, group collaboration tools, etc. An advisory panel would be needed to offer expertise in various relevant areas such as education, social networking, social science, economics, etc. to ensure that the appropriate user groups are successfully engaged.

Sustainability

This group set itself two tasks for this session. One was to try to come up with suggestions for how the connections initiated at the meeting in Japan could be developed further. The second was, given the expertise of the workshop participants, how one may come up with possible topics for international interdisciplinary research that would address sustainability challenges.

With regards to the first topic, workshop participants felt ultimately that properly placed calls for proposals (i.e. funding initiatives) would be very important to foster international and interdisciplinary research among connection participants. There was also a strong interest among participants from both Japan and the US in holding a reverse visit within the next year, in which Japanese researchers visit the US. In addition, we felt that overall the scientific topics being discussed were very broad and more narrow focus target workshops in research areas of interest to participants would perhaps be very useful in developing more credible research proposals. We also felt contact lists of female faculties from both countries with a short description of research interests may be very useful. This could come in the form of a wiki page. While we realized that is sometimes difficult to obtain this data from universities, we felt that it may be more expedient and relevant to have female faculty self identify who are interested in such collaborations. Finally, a common theme at the meeting was the strength of female scientists in the area of social networking. To capitalize on this we suggest that a connections website with a newsgroup, blogs, and links might be a great way to initiate international interdisciplinary collaborations. This website could also host the above-mentioned lists of female researchers with an interest in such collaborations.

The second topic was addressed by a ‘speedstorming’ session. Beth Pruitt introduced the group to the procedure. The participating scientists paired up in groups of two, briefly introduced themselves (their research interests) for one min. Then, they discussed possible collaborations on the topic of sustainability that would be of mutual interest for two min. They spent the final minute arriving at a one-sentence summary of the proposed activity. In total everyone participated in three speedstorming sessions. The one-sentence summaries were reported out to the group; there was some overlap in the possible proposed activities. We chose this way to address the question of how to arrive at suitable topics for international interdisciplinary collaborations in the area of sustainability to (1) incorporate all participants into the discussion and (2) tackle a very broad topic efficiently. Both goals were met. The next step would have been to try to arrive at two or three high priority research topics based on the one sentence summaries, we did not complete this step. This would have been a good consensus building mechanism, however we did not have enough time to do this justice and it felt a bit premature to try to attempt. We decided to use the following one-sentence summaries instead as possible examples of collaboration topics between participants.

1. Coordination for identification of high priority traits in plants, germplasm and information exchange. Stewart-ship
2. Connection climate change and land slide hazard risk.
3. Coastal impacts of climate change (wet land erosion and climate change)
4. Marine litter in ocean (island nations): clean up technology & prevention
5. Localized climate prediction and understanding of basic plant response that might enhance fitness in light of specific climate constraints
6. Technology & policies for agriculture & environment monitoring and management
7. Water purification, management, and monitoring
8. Enhanced plant fitness in climate change: trade offs between nutrition or energy yield & adaptation
9. Personalized environmental monitoring (health hazards)
10. Understanding regulation of processes linked to sustainability in model species and use computational biology and genome CIS information to extrapolate to other species for crop yield/biodiversity.

Materials by Design

This group worked to identify important challenges in the general area of materials and nanoscale materials. Applications for materials and nanomaterials demand interdisciplinary expertise for development. For example, both biocompatible materials (whether for medical devices, bone replacement, tissue engineering) and nanoscale drug delivery systems require deep understanding of materials, nanomaterials, biology, and surface science. Materials and nanomaterials are also important for catalysis, energy generation, and the environment (e.g. water purification).

The scientists in this group were quite diverse but found general agreement about the intellectual areas that need to be advanced before such applications can be developed. For example, the interface (surface interaction) between biological, inorganic and organic materials. The breakout group envisions that truly complex systems or multi-component systems that combine many types of materials with a variety of interfaces, will be important. Fundamental processes such as phase transformations, kinetic nucleation, and self-assembly need elucidation.

Many current materials characterization techniques require ultra-high vacuum conditions, which may alter properties fundamental to their function. The ability to characterize and measure nanoscale materials in situ would likely lead to breakthroughs in several applications described above. In addition, theoretical development particularly forming a bridge between DFT and molecular dynamics would have significant impact on these areas.

Breakout 3: Building Leadership Skills

The focus of Breakout 3 was to discuss the qualities of a leader. The objective was to provide the women participating in this workshop with the tools needed to know how to recognize and pursue leadership opportunities when they arise. Interestingly, there were some strong differences between the Japanese and US views on what qualities a leader should exhibit. This discovery shaped a large part of the discussions.

The discussion suggested that leaders

- Take opportunities that arise.
- Are very good listeners.
- Are able to make decisions
- Can develop and communicate a vision.
- Know how to prioritize tasks and allocate resources (delegate).
- Are aware of the potential consequences of a decision
- Know when one should fight for something and when to accept an alternate outcome.

It was also recommended that to become a leader one must

- Ask for advice from those who have been successful.
- Promote the work that you are doing when possible.
- Ask for opportunities rather than waiting for them to come to you.

Additionally, some mechanisms that will develop leadership skills

- Organizing sessions at conferences.
- Taking on leadership positions in one's department, and recognizing which are leadership positions.
- Joining technical committees.
- Leading a team to write a proposal or complete a task.
- Coming to this workshop and leading a discussion.

The Next Steps:

After the workshop the participants from the US are visiting several research institutions around Japan to pursue collaborative project ideas. They are giving seminars, meeting researchers, seeing facilities, etc. Additionally, this experience will increase their awareness with the culture of Japan, an experience which they can all bring back to their home institutions to share with their research teams and colleagues.

The group resolved to support each other as much as possible, by helping to make contacts with others at their home institution and by making invitations to give seminars. It seems that this type of support system will be invaluable for the participants in terms of making further connections.

The participants will be tracked to the extent possible. We asked all participants to email us about their experiences in Japan and to notify the organizers if they do begin new collaborations as an outcome of this meeting. Additionally, we will follow up with them in about one year to find out how this workshop might have influenced their research activities and career goals.

The group strongly suggested that we have a follow-up meeting in the US that will be co-organized by the US and Japanese. The Japanese participants will pursue funding for the travel expenses to bring a group of young leaders to such an event. Some possible locations are San Francisco (UC Berkeley and Stanford), Cold Springs Harbor Lab, and Hawaii (the University of Hawaii).

Acknowledgement

Funding was provided for this event by the US National Science Foundation, the Japan Society for the Promotion of Science, the Japan Science and Technology Agency of Japan and the National Women's Education Center.

Special thanks go to Maki Kubo (NWEC), Hazuki Nakata (NWEC), Machi Dilworth (NSF), Kazuko Shinohara (NSF) and Anne Emig (NSF).

Appendices:

Near the end of *Connections* a questionnaire was circulated to get some feedback from the group of participants on the success of the workshop. The questions included:

What do you feel was the most useful element of this meeting for you personally?
What do you feel was the least useful element of this meeting for you personally?
How might we have made this event more helpful for you at this point in your career?
Is there a different topic that you would have liked to discuss here?
Describe one way in which you plan to use the information from this meeting in your career.
Have you met some possible future collaborators during this event?

Summary of Responses to Questionnaire

The participants overwhelmingly felt that the meeting was a success and would be beneficial to their career aspirations. Many felt that attending this meeting provided them with additional confidence in being a successful researcher and the interactions with other faculty provided them with ideas on how to promote themselves, take on leadership tasks and advance in an academic setting.

Some suggestions for future meetings included:

- Participants going on site visits should report on their experiences and share with the rest of the group
- The exposure to senior women scientists and engineers was a fantastic aspect of the meeting and should be expanded in the future
- We should have longer poster sessions to allow us to get to know the research better